WHAT IS CLAIMED IS:

1. A method for cleaning a plasma etching apparatus comprising the steps of:

filling a chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas wherein BO_x is adhered to an inside of the chamber as a residue; and

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas to remove the BO_x.

2. A method for cleaning a plasma etching apparatus according to claim 1, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

3. A method for cleaning a plasma etching apparatus according to claim 1, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

4. A method for cleaning a plasma etching apparatus according to claim 2, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

5. A method for cleaning a plasma etching apparatus according to claim 1, wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed

gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

6. A method for cleaning a plasma etching apparatus according to claim 2, wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

7. A method for cleaning a plasma etching apparatus according to claim 3, wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

8. A method for cleaning a plasma etching apparatus comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in a chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas after the plasma etching; and

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas.

9. A method for cleaning a plasma etching apparatus according to claim 8, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

10. A method for cleaning a plasma etching apparatus according to claim 8, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

11. A method for cleaning a plasma etching apparatus according to claim 9, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

12. A method for cleaning a plasma etching apparatus according to claim 8, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

13. A method for cleaning a plasma etching apparatus according to claim 9, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

14. A method for cleaning a plasma etching apparatus according to claim 10, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

15. A method for cleaning a plasma etching apparatus comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in a chamber;

replacing the etching gas in the chamber with a mixed gas of Cl_2 and a fluorine-based gas or Cl_2 after the plasma etching; and

generating plasma from the mixed gas of Cl_2 and the fluorine-based gas or the Cl_2 before a plasma etching using a gas that is inhibited from generating plasma by BO_x as an etching gas.

16. A method for cleaning a plasma etching apparatus according to claim 15, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

17. A method for cleaning a plasma etching apparatus according to claim 15, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

18. A method for cleaning a plasma etching apparatus according to claim 16, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

19. A method for cleaning a plasma etching apparatus according to claim 15, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed

gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

20. A method for cleaning a plasma etching apparatus according to claim 16, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

21. A method for cleaning a plasma etching apparatus according to claim 17, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

22. A method for cleaning a plasma etching apparatus comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in a chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas after the plasma etching; and

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas before performing plasma etching using a gas containing SF_6 as an etching gas.

23. A method for cleaning a plasma etching apparatus according to claim 22, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

24. A method for cleaning a plasma etching apparatus according to claim 22, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

25. A method for cleaning a plasma etching apparatus according to claim 23, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

26. A method for cleaning a plasma etching apparatus according to claim 22, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

27. A method for cleaning a plasma etching apparatus according to claim 23, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

28. A method for cleaning a plasma etching apparatus according to claim 24, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

29. A method for cleaning a plasma etching apparatus including a chamber,

said method comprising the steps of:

filling the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas; and

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas,

wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber,

wherein BO_x is adhered to the surface of the quartz at least partly exposed to the inside of the chamber as a residue.

30. A method for cleaning a plasma etching apparatus according to claim 29, wherein a method selected form the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

31. A method for cleaning a plasma etching apparatus according to claim 29, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

32. A method for cleaning a plasma etching apparatus according to claim 30, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

33. A method for cleaning a plasma etching apparatus according to claim 29,

wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

34. A method for cleaning a plasma etching apparatus according to claim 30, wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

35. A method for cleaning a plasma etching apparatus according to claim 31, wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

36. A method for cleaning a plasma etching apparatus including a chamber, said method comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in the chamber;

replacing the etching gas in the chamber with a mixed gas of Cl_2 and a fluorine-based gas or Cl_2 after the plasma etching; and

generating plasma from the mixed gas of Cl_2 and the fluorine-based gas or the Cl_2,

wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

37. A method for cleaning a plasma etching apparatus according to claim 36, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

38. A method for cleaning a plasma etching apparatus according to claim 36, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

39. A method for cleaning a plasma etching apparatus according to claim 37, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

40. A method for cleaning a plasma etching apparatus according to claim 36, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

41. A method for cleaning a plasma etching apparatus according to claim 37, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

42. A method for cleaning a plasma etching apparatus according to claim 38,

wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

43. A method for cleaning a plasma etching apparatus including a chamber, said method comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in the chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas after the plasma etching; and

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas before performing plasma etching using a gas that is inhibited from generating plasma by BO_x as an etching gas,

wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

44. A method for cleaning a plasma etching apparatus according to claim 43, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

45. A method for cleaning a plasma etching according to claim 43, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

46. A method for cleaning a plasma etching apparatus according to claim 44, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

47. A method for cleaning a plasma etching apparatus according to claim 43, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

48. A method for cleaning a plasma etching apparatus according to claim 44, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

49. A method for cleaning a plasma etching apparatus according to claim 45, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

50. A method for cleaning a plasma etching apparatus including a chamber, said method comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in the chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas after the plasma etching; and

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas before performing plasma etching using a gas containing SF_6 as an etching gas,

wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

51. A method for cleaning a plasma etching apparatus according to claim 50, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

52. A method for cleaning a plasma etching apparatus according to claim 50, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

53. A method for cleaning a plasma etching apparatus according to claim 51, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

54. A method for cleaning a plasma etching apparatus according to claim 50, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

55. A method for cleaning a plasma etching apparatus according to claim 51,

wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

56. A method for cleaning a plasma etching apparatus according to claim 52, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

57. A method for plasma etching comprising the steps of:

performing plasma etching a conductive film using a gas containing BCl_3 gas as an etching gas in a chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas after the plasma etching; and

generating a plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas before performing plasma etching using a gas that is inhibited from generating plasma by BO_x as an etching gas.

58. A method for plasma etching according to claim 57, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

59. A method for plasma etching according to claim 57, wherein the

fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

60. A method for plasma etching according to claim 58, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

61. A method for plasma etching according to claim 57, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

62. A method for plasma etching according to claim 58, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

63. A method for plasma etching according to claim 59, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

64. A method for plasma etching comprising the steps of:

performing plasma etching using a gas containing BCl_3 gas as an etching gas in a chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas after the plasma etching;

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas; and

performing plasma etching using a gas containing SF_6 gas as an etching gas.

65. A method for plasma etching according to claim 64, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

66. A method for plasma etching according to claim 64, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

67. A method for plasma etching according to claim 65, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

68. A method for plasma etching according to claim 64, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

69. A method for plasma etching according to claim 65, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

70. A cleaning method for plasma etching apparatus according to claim 66, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

71. A method for plasma etching using a plasma etching apparatus including a chamber, said method comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in the chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas after the plasma etching;

generating plasma from Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas; and

performing plasma etching using a gas that is inhibited from generating plasma by BO_x as an etching gas,

wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

72. A method for plasma etching according to claim 71, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

73. A method for plasma etching according to claim 71, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

74. A method for plasma etching according to claim 72, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

75. A method for plasma etching according to claim 71, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

76. A method for plasma etching according to claim 72, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

77. A method for plasma etching according to claim 74, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

78. A method for plasma etching using a plasma etching apparatus including a chamber, said method comprising the steps of:

performing plasma etching using a gas containing BCl_3 as an etching gas in the chamber;

replacing the etching gas in the chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas after the plasma etching;

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas; and

performing plasma etching using a gas containing SF_6 gas as etching gas,

wherein a part of the chamber is made from quartz, and a surface of the quartz is at least partly exposed to an inside of the chamber.

79. A method for plasma etching according to claim 78, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

80. A method for plasma etching according to claim 78, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

81. A method for plasma etching according to claim 79, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

82. A method for plasma etching according to claim 78, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

83. A method for plasma etching according to claim 79, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

84. A method for plasma etching according to claim 80, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2.

85. A method for manufacturing a semiconductor device comprising the steps of:

laminating a first conductive film and a second conductive film in sequence over an island shape semiconductor film with a gate insulating film interposed therebetween;

etching the first conductive film and the second conductive film to form a first shape of the first conductive film and a first shape of the second conductive film, respectively, by using a first etching gas;

replacing the first etching gas in a chamber with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas wherein BO_x is adhered to an inside of the chamber as a residue; and

generating plasma from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas to remove the BO_x; and

anisotropic etching the first shape of the first conductive film and the first shape of the second conductive film to form a second shape of the first conductive film

and a second shape of the second conductive film, respectively.

86. A method for manufacturing a semiconductor device according to claim 85, wherein a width of the second shape of the first conductive film is longer than that of the second shape of the second conductive film in a channel length direction.

87. A method for manufacturing a semiconductor device according to claim 85, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

88. A method for manufacturing a semiconductor device according to claim 86, wherein a method selected from the group consisting of an RIE etching method, an ICP etching method, an ECR etching method, a helicon wave etching method, a helical resonance etching method and a pulse modulation etching method is adopted in the plasma etching apparatus.

89. A method for manufacturing a semiconductor device according to claim 85, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

90. A method for manufacturing a semiconductor device according to claim 86, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

91. A method for manufacturing a semiconductor device according to claim 87, wherein the fluorine-based gas is selected from the group consisting of CF_4, SF_6 and NF_3.

92. A method for manufacturing a semiconductor device according to claim 85, wherein an etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas, or Cl_2 gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 to remove the BO_x.

93. A method for manufacturing a semiconductor device according to claim 86, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 to remove the BO_x.

94. A method for manufacturing a semiconductor device according to claim 87, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 to remove the BO_x.

95. A method for manufacturing a semiconductor device according to claim 89, wherein the etching gas is replaced with Cl_2 or a mixed gas of Cl_2 and a

fluorine-based gas each of which is added with O_2, and plasma is generated from the Cl_2 or the mixed gas of Cl_2 and the fluorine-based gas each of which is added with O_2 to remove the BO_x.

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